# System and Method for Autonomic Wireless Presence Ping

## BACKGROUND OF THE INVENTION

### 1. Technical Field

The present invention relates in general to a system and method for autonomic wireless presence ping. More particularly, the present invention relates to a system and method for client devices to provide enhanced status information to an administrator that, in turn, allows the administrator to identify spatial capacity requirements within a network.

### 2. Description of the Related Art

Wireless LANs are increasing in popularity and becoming accepted for use in enterprise networks. As expected, users require the same level of consistency and quality of service from wireless LANs as they do with traditional wired LANs. A wireless LAN, however, is fundamentally different than a wired LAN, and being able to provide the same quality of service in a wireless LAN requires overcoming some key technical challenges.

In the case of 802.11b wireless LAN technology, a shared transmission medium exists between an access point and client devices that defines fourteen separate channels in which to communicate. However, only three of the fourteen channels are non-overlapping in frequency spectrum. Therefore, since there are only three non-overlapping channels, a challenge found is that an information system administrator may only use the three

non-overlapping channels in an adjacent, honeycomb pattern for a network layout. This limitation prohibits the amount of traffic that an 802.11b network may support. For example, a single 802.11b channel's throughput is about 5.5 Mbps. Since an 802.11b layout is limited to three channels, an 802.11b network's maximum capacity is about 16.5 Mbps.

Information system administrators may prefer to deploy 802.11b networks given that they are the lowest cost and most stable compared to the other 802.11 standards, such as 802.11a and 802.11g. 802.11a and 802.11g networks may, however, be overlaid in hot spots to address capacity issues. A challenge found is for an information system administrator to identify actual spatial capacity requirements within a given wireless network. A wired network uses a dedicated medium between a hub and a client that allows a hub to continually receive actual demand from a client. In a wireless network, however, due to its shared transmission medium, an access point only receives a single demand from a single client at any given time.

What is needed, therefore, is a system and method to identify actual spatial capacity requirements for client devices that communicate over a wireless LAN environment.

**SUMMARY**

It has been discovered that the aforementioned challenges are resolved by using an enhanced presence ping to instruct client devices to provide enhanced status information to an access point that allows an information system administrator to identify a network's actual spatial capacity requirements. An information system administrator wishes to collect enhanced status information corresponding to client devices that an access point supports. For example, enhanced status information may be a client's total packets sent to and received from the access point.

The information system administrator sends an administrator request to the access point over a computer network, such as the Internet. The access point receives the request, and determines that is should notify client devices to enable enhanced presence ping. The access point generates an enhanced presence ping control packet, and sends the enhanced presence ping control packet to each client device over a wireless network, such as 802.11b. The enhanced presence ping control packet instructs each client device to enable an enhanced presence ping bit, and also instructs each client device as to which type of enhanced status information to collect and send to the access point.

Each client device receives the enhanced presence ping control packet, and enables an enhanced presence ping bit. In addition, each client device identifies, based upon the enhanced presence ping control packet, whether it should push enhanced status information to the access point or

whether it should wait for a ping request from the access point before providing the enhanced status information.

If a client device identifies that it should push enhanced status information to the access point, the client device enables a timer. The timer is set at particular intervals, such as hourly, and instructs the client device when to send enhanced status information to the access point. When the timer expires, the client device collects the enhanced status information, includes it in a response, and sends the response to the access point. The access point receives the enhanced status information, and passes the enhanced status information to the IS administrator through a computer network.

If, on the other hand, the client device identifies that it should not push the enhanced status information to the access point, the client device waits for a ping request from the access point. When the client device receives the ping request, the client device collects the enhanced status information, includes it in a response, and sends the response to the access point.

The foregoing is a summary and thus contains, by necessity, simplifications, generalizations, and omissions of detail; consequently, those skilled in the art will appreciate that the summary is illustrative only and is not intended to be in any way limiting. Other aspects, inventive features, and advantages of the present invention, as defined solely by the claims, will become apparent in the non-limiting detailed description set forth below.

## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be better understood, and its numerous objects, features, and advantages made apparent to those skilled in the art by referencing the accompanying drawings. The use of the same reference symbols in different drawings indicates similar or identical items.

**Figure 1** is a diagram showing a client providing enhanced status information in response to an enhanced presence ping request;

**Figure 2** is a data packet diagram showing various data that is sent from a client to an access point;

**Figure 3** is a flowchart showing steps taken in an access point receiving an enhanced presence ping request, and sending control packets to clients that instruct the clients to provide enhanced status information to the access point;

**Figure 4** is a high level flow chart showing steps taken in a client receiving a control packet from an access point, and enabling its enhanced presence ping bit in response to the control packet;

**Figure 5** is a flowchart showing steps taken in a client collecting enhanced presence information and sending the enhanced presence information to an access point;

**Figure 6** is a block diagram of an access point that is capable of adapting to the present invention; and

**Figure 7** is a block diagram of an information handling system, such as a client device, capable of implementing the present invention.

## DETAILED DESCRIPTION

The following is intended to provide a detailed description of an example of the invention and should not be taken to be limiting of the invention itself. Rather, any number of variations may fall within the scope of the invention which is defined in the claims following the description.

**Figure 1** is a diagram showing a client providing enhanced status information to an access point. Administrator **100** wishes to collect enhanced status information corresponding to clients that access point **130** supports. For example, enhanced status information may be a client's total packets sent to and received from access point **130**. Administrator **100** sends administrator request **110** to access point **130** over computer network **120**, such as the Internet. Access point **130** receives the request, and determines that is should notify clients to enable enhanced presence ping.

Access point **130** communicates with client **150** over wireless network **140**, such as an 802.11 network. Access point **130** generates enhanced presence ping control packet **160**, and sends enhanced presence ping control packet **160** to client **150** over wireless network **140**. Enhanced presence ping control packet **160** instructs client **150** to enable enhanced presence ping mode, and also instructs client **150** as to what type of enhanced status information to collect.

Client **150** receives enhanced presence ping control packet **160**, and enables an enhanced presence ping bit (see **Figure 4** and corresponding text for further details

regarding enhanced presence ping bit setting). Client **150** also determines, based upon enhanced presence ping control packet **160**, whether it should push enhanced status information to access point **130**, or whether it should wait for a ping request from access point **130** before providing the enhanced status information. If client **150** determines that it should push enhanced status information to access point **130**, client **150** enables timer **155**. Timer **155** is set at particular intervals, such as thirty minutes, and instructs client **150** when to send enhanced status information to access point **130**.

When timer **155** expires, client **150** collects enhanced status information **180**, includes it in response **190**, and sends response **190** to access point **130**. Access point **130** receives enhanced status information **180**, and passes enhanced status information **180** to administrator **100** through computer network **120**. If, on the other hand, client **150** was not requested to push enhanced status information to access point **130**, client **150** waits for ping request **170** from access point **130**. When client **150** receives ping request **170**, client **150** collects enhanced status information **180**, includes it in response **190**, and sends response **190** to access point **130**.

**Figure 2** is a diagram of a response packet that is sent from a client to an access point. Response **190** is the same as that shown in **Figure 1** and includes network header **200** and data packet **240**. Network header **200** includes MAC header **210**, IP header **220**, and UDP header **230**, each of which includes various network information corresponding to a client/access point connection.

Data packet **240** includes data format **250** and enhanced status information **180**. Data format **250** includes up to three types of data which may be data corresponding to bandwidth, configuration, and power. Enhanced status information **180** is the same as that shown in **Figure 1** and includes the enhanced status information corresponding to the data type selections located in data format **250**. For example, if a client is requested to send bandwidth information, the client may include total packets sent in enhanced status information **180**. In another example, if the client is requested to provide configuration information, the client may include a signal strength reading. In yet another example, if the client is requested to provide power information, the client may include a system power state in enhanced status information **180** to send to an access point.

**Figure 3** is a flowchart showing steps taken in an access point receiving an enhanced presence ping request, and sending control packets to clients that instruct the clients to provide enhanced status information to the access point. Access point processing commences at **300**, whereupon processing receives an administrator request from administrator **100** (step **310**). Administrator **100** is the same as that shown in **Figure 1**.

A determination is made as to whether administrator **100** wishes to enable enhanced presence ping based upon the administrator request (decision **320**). Enhanced presence ping instructs an access point to inform clients to provide enhanced status information, such as the total number of packets that a client transmits and receives (see **Figure 2** and corresponding text for further details regarding status

information). If administrator **100** does not wish to enable enhanced presence ping, decision **320** branches to "No" branch **322** bypassing enhanced presence ping enablement steps.

On the other hand, if administrator **100** wishes to enable enhanced presence ping, decision **320** branches to "Yes" branch **328** whereupon the access point generates an enhanced presence ping control packet (step **330**). The enhanced presence ping control packet instructs a client to enable enhanced presence ping and which type of enhanced status information to collect. Processing sends the control packet to client **150** at step **340**. Client **150** is the same as that shown in **Figure 1**. In one embodiment, the access point sends the control packet to each client that is active on the access point's network. Processing informs new associations that enhanced presence ping is enabled at step **350**. For example, when a new client joins the access point's network, the access point promptly informs the new client to enable enhanced presence ping instead of the client having to wait for a broadcast announcement.

Processing sends a ping request to client **150** at step **360**, and receives a ping response at step **370**. If client **150**'s enhanced presence ping bit is enabled, client **150** includes enhanced status information in its ping response (see **Figure 5** and corresponding text for further details regarding client response). A determination is made as to whether to continue processing (decision **380**). If processing should continue, decision **380** branches to "Yes" branch **382** which loops back and waits for the access point's timer interval to expire (step **390**). The

administrator request included a timer interval corresponding to when to retrieve enhanced status information. This looping continues until processing should stop, at which point decision **380** branches to "No" branch **388** whereupon processing ends at **399**.

**Figure 4** is a high level flow chart showing steps taken in a client receiving a control packet from an access point, and enabling its enhanced presence ping bit in response to the control packet. Client configuration processing commences at **400**, whereupon processing waits for control packets from access point **130** at step **410**. The control packets include information as to whether the client should enable enhanced presence ping that, in turn, instructs the client to provide enhanced status information to access point **130**. Access point **130** is the same as that shown in **Figure 1**.

A determination is made as to whether the client should enable enhanced presence ping (decision **420**). If the client should not enable enhanced presence ping, decision **420** branches to "No" branch **422** which loops back to wait for more control packets. This looping continues until the client receives a control packet that instructs it to enable enhanced presence ping, at which point decision **420** branches to "Yes" branch **428** whereupon processing sets an enhanced presence ping bit in register **440** at step **430**.

A determination is made as to whether the client should wait for access point ping requests or whether the client should set a timer and provide enhanced status information to access point **130** each time the timer expires

(decision **450**). If the client should enable a timer, decision **450** branches to "Timer" branch **452** whereupon processing enables timer **155** at step **460**. Timer **155** is the same as that shown in **Figure 1**. On the other hand, if processing should wait for access point ping requests before sending enhanced status information, decision **450** branches to "Ping" branch **458** bypassing timer setting steps.

A determination is made as to whether to continue client processing (decision **470**). If client processing should continue, decision **470** branches to "Yes" branch **472** which loops back to process more control packets. This looping continues until client processing should stop, at which point decision **470** branches to "No" branch **478** whereupon processing ends at **480**.

**Figure 5** is a flowchart showing steps taken in a client collecting enhanced status information and sending the enhanced status information to an access point. Client operation processing commences at **500**, whereupon processing checks an enhanced presence ping bit located in register **440** at step **505**. The enhanced presence ping bit may have been previously enabled in response to an access point control packet request (see **Figure 4** and corresponding text for further details regarding access point control packet requests). Register **440** is the same as that shown in **Figure 4**.

A determination is made as to whether the enhanced presence ping bit is enabled (decision **510**). If the enhanced presence ping bit is not enabled, decision **510** branches to "No" branch **512** which loops back to respond to

access point **130**'s pings in a typical manner (step **515**). Access point **130** is the same as that shown in **Figure 1**. This looping continues until the enhanced presence ping bit is enabled, at which point decision **510** branches to "Yes" branch **518**.

A determination is made as to whether a timer, such as timer **155**, is enabled (decision **520**). If timer **155** is enabled, decision **520** branches to "Yes" branch **522** whereupon processing waits for timer **155** to expire (step **530**). On the other hand, if timer **155** is not enabled, decision **520** branches to "No" branch **528** whereupon processing waits for a ping request from access point **130** at step **540**.

When the client is finished waiting for a ping request, or timer **155** has expired, the client checks the format of an enhanced presence ping control packet to identify which type of status information to collect Processing collects enhanced status information based upon the enhanced presence ping control packet at step **560**. Processing formats a response that includes the enhanced status information at step **570**, and sends response **190** to access point **130** at step **580**. Response **190** is the same as that shown in **Figure 1**.

A determination is made as to whether to continue processing (decision **590**). If processing should continue, decision **590** branches to "Yes" branch **592** which loops back to collect more enhanced status information. This looping continues until client processing should stop, at which point decision **590** branches to "No" branch **598** whereupon processing ends at **599**.

**Figure 6** is a block diagram of an access point that is capable of adapting to the present invention. Access point **130** is the same as that shown in **Figure 1** and includes three modules which are LAN interface **605**, base band processing **640**, and wireless interface **670**. LAN interface **605** includes physical layer **615** that provides an interface, such as Ethernet, to computer network **120**. TX FIFO **620** and RX FIFO **625** couples physical layer **615** to controller **630** and provides buffering for transmit and receive data packets.

Controller **630** couples to flow control **645** that is included in base band processing **640** through a standard bus, such as a PCI or ISA bus. Flow control **645** couples to processor **650** that manages base band operations. Processor **650** couples to program store **655** to retrieve program information. Program store **655** is a non-volatile storage device, such as non-volatile memory. Processor **650** is also coupled to memory **660** that is a volatile storage device, such as volatile memory. Memory **660** includes bit **665** which is set when access point 130 is in enhanced presence ping mode.

Flow control **645** interfaces with controller **675** through a standard bus, such as a PCI or ISA bus. TX FIFO **680** and RX FIFO **685** couple controller **675** to transceiver **690** and are used to buffer transmission and reception of data packets that are sent to and received from a client over wireless network **140**. Transceiver **690** is coupled to antenna **695** that transmits and receives data packets over wireless network **140**.

**Figure 7** is a block diagram of an information handling system, such as a client device, capable of implementing the present invention. **Figure 7** illustrates client **150**

which is a simplified example of a client capable of performing the computing operations described herein. Client **150** includes wireless interface **710** that includes transceiver **715**. Transceiver **715** is an RF (radio frequency) transmitter that uses antenna **755** to communicate with other devices on infrastructure network **140**. Client **150** and infrastructure network **140** are the same as that shown in **Figure 1**.

TX FIFO **720** and RX FIFO **725** couple controller **730** to transceiver **715** and are used to buffer transmission and reception of data packets that are sent to and received from network devices. Controller **730** includes timer **155** and enhanced presence ping bit **740**. Client **150** checks enhanced presence ping bit **740** to determine whether to be in enhanced presence ping mode. Timer **155**, if enabled is used to identify times at which to send enhanced status information to an access point.

PCI bus controller **760** operationally couples a variety of modules within client **150**. A standard processing subsection is coupled to PCI bus controller **760** and consists of microprocessor **770**, memory controller **765**, and memory **772**. PCI bus controller **760** is also coupled to keyboard/mouse **775** in which a user uses to input information, such as a network name. PCI bus controller **760** is also coupled to DASD **780** that includes hard drive **785** and optical device **786**. Client **150** also includes video controller **790** which displays data on display **795** for a user to view.

While the computer system described in **Figure 7** is capable of executing the processes described herein, this

computer system is simply one example of a computer system. Those skilled in the art will appreciate that many other computer system designs are capable of performing the processes described herein.

One of the preferred implementations of the invention is an application, namely, a set of instructions (program code) in a code module which may, for example, be resident in the random access memory of the computer. Until required by the computer, the set of instructions may be stored in another computer memory, for example, on a hard disk drive, or in removable storage such as an optical disk (for eventual use in a CD ROM) or floppy disk (for eventual use in a floppy disk drive), or downloaded via the Internet or other computer network. Thus, the present invention may be implemented as a computer program product for use in a computer. In addition, although the various methods described are conveniently implemented in a general purpose computer selectively activated or reconfigured by software, one of ordinary skill in the art would also recognize that such methods may be carried out in hardware, in firmware, or in more specialized apparatus constructed to perform the required method steps.

While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that, based upon the teachings herein, changes and modifications may be made without departing from this invention and its broader aspects and, therefore, the appended claims are to encompass within their scope all such changes and modifications as are within the true spirit and scope of this invention. Furthermore, it is to be understood that the invention is solely defined by the

appended claims. It will be understood by those with skill in the art that if a specific number of an introduced claim element is intended, such intent will be explicitly recited in the claim, and in the absence of such recitation no such limitation is present. For a non-limiting example, as an aid to understanding, the following appended claims contain usage of the introductory phrases "at least one" and "one or more" to introduce claim elements. However, the use of such phrases should not be construed to imply that the introduction of a claim element by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim element to inventions containing only one such element, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an"; the same holds true for the use in the claims of definite articles.